

UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

Foundation Year 2011/2012

COMPUTING AND INFORMATION SYSTEMS

IS50002 (FY02)

Foundation Mathematics for Computing

Duration: 3 hours

Date: Thursday 10th May 2012

Time: start 10:00 finish 13:00

You should answer all the questions on this paper. There are ten questions in total. Full marks will be awarded for complete answers to all ten questions. Each question is worth 10 marks. The marks for each part of a question are indicated at the end of the part in [.] brackets.

There are 100 marks available on this paper.

No calculators should be used.

Graph paper will be provided.

**THIS PAPER MUST NOT BE REMOVED
FROM THE EXAMINATION ROOM**

Question 1 This question is about fractions, decimals percentages, standard form and significant figures.

a)

i. Find 35% as a fraction in its simplest form.

ii. Write $\frac{42}{50}$ as a decimal.

[2]

b) James, Jared and Julia buy premium bonds in the ratio 3: 1: 4. Julia's share is £1000.

i. How much is James's share?

ii. How much have the three of them spent in total?

[2]

c) Write the following numbers correct to 3 significant figures.

i. 36400.7347

ii. 3.0064

[2]

d) Write the following numbers correct to 2 decimal places.

i. 3647.7347

ii. 3.0064

[2]

e) Calculate $(3.2 \times 10^3) \div (4 \times 10^{-2})$. Give your answer in standard form.

[2]

Question 2 This question is about algebraic expressions and indices.

a) Expand the following expressions.

i. $(abc)^2(abc^2)$

ii. $(p + q)(p - 2q)$

[2]

b) Evaluate $(p + q)(p - 2q)$ when $p = 2$ and $q = -3$

[1]

c) Simplify the following expressions, give answers in their simplest form

i. $\frac{1}{2x} - \frac{2}{3}$

ii. $\frac{6zx}{5y} \times \frac{5}{3yx}$

[2]

d) Simplify the following expressions.

i. $(x^5)^{-2}$

ii. $x \div x^{-4}$

[2]

e) Evaluate:

i. $81^{\frac{1}{2}}$

ii. $27^{-\frac{2}{3}}$

[3]

Question 3 This question is about bases and matrices.

a) Calculate $503_8 + 476_8$. Show your working in octal.

[2]

b) Convert $2F6_{16}$ to decimal.

[1]

c) Convert 1100011_2 to:

i. decimal

ii. hexadecimal

[2]

d) Evaluate

$$\begin{pmatrix} 4 & 3 \\ -1 & 3 \end{pmatrix} \begin{pmatrix} 2 \\ -1 \end{pmatrix}$$

[2]

e) Find the inverse M^{-1} of the following matrix M .

$$M = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$$

[2]

f) What is the result of multiplying this inverse M^{-1} by the original matrix M ?

[1]

Question 4 This question is about linear, simultaneous and quadratic equations.

a) Solve the following equations.

i. $12 = (1 - x) \times 3$

ii. $\frac{1}{2x} + \frac{1}{3x} = 5$

[3]

b) Solve the following quadratic equations.

i. $x^2 - 5x + 6 = 0$ by factorizing

ii. $2x^2 - 5x + 3 = 0$ by factorizing

iii. $2x^2 - 5x + 4 = 0$ by using the quadratic formula

[3]

c) Solve the following simultaneous equations.

i.
$$\begin{cases} 2x - 5y = 6 \\ 2x - 8y = 9 \end{cases}$$

ii.
$$\begin{cases} 2x - 5y = -11 \\ 3x - 2y = 0 \end{cases}$$

[4]

Question 5 This question is about sequences and series.

Consider the following sequences:

$$a_i = \frac{2}{5^i} \quad b_i = 2i - 5 \quad c_i = 2 - 5i \quad d_i = \frac{3}{2^i} \quad i = 1, 2, 3 \dots$$

- a) Decide which of the 4 sequences are arithmetic progressions, geometric progressions or neither

[4]

- b) Find a_1 and a_2 for $a_i = \frac{2}{5^i}$

[2]

- c) Find the 50th term of $c_i = 2 - 5i$

[2]

- d) Find the sum to infinity of $d_i = \frac{3}{2^i}$

[2]

Question 6 This question is about functions.

Consider the following functions:

$$f(x) = x^2 - 7 \qquad g(x) = 2x - 5 \qquad h(x) = \frac{1}{x} \quad (x \neq 0)$$

a) Evaluate the following.

- i. $f(2)$
- ii. $g(-2)$
- iii. $h(g(2))$
- iv. $f(h(g(0)))$

[4]

b) Write an expression for:

- i. $f(2x)$
- ii. $g(h(x))$

[2]

c) Find

- i. $g^{-1}(x)$
- ii. $h^{-1}(x)$
- iii. hence, or otherwise, find the inverse of $g(h(x))$

[4]

Question 7 This question is about logic and sets.

a) Copy and complete the truth tables for the following logical expressions. Hence decide whether each is a tautology, a contradiction or a contingency.

i. $(P \wedge \neg P) \rightarrow Q$

P	Q	$\neg P$	$P \wedge \neg P$	$(P \wedge \neg P) \rightarrow Q$

ii. $Q \rightarrow (P \wedge \neg P)$

P	Q	$\neg P$	$P \wedge \neg P$	$Q \rightarrow (P \wedge \neg P)$

[5]

b) $A, B,$ and C are subsets of a universal set \mathcal{E} as follows:

$$\mathcal{E} = \{x: x \text{ is an integer and } 0 < x \leq 20\}$$

$$A = \{x: x \text{ is a multiple of } 5\}$$

$$B = \{15, 16, 17, 18, 19, 20\}$$

$$C = \{x: x \text{ is an even number}\}$$

List the following sets:

i. $A \cup B$

ii. $B \cap C'$ where C' is the complement of C

iii. $(A \cup B) \cap C$

[3]

c) Shade the following regions on separate Venn diagrams for general sets A and B

i. $A' \cup B'$

ii. $(A \cup B)'$

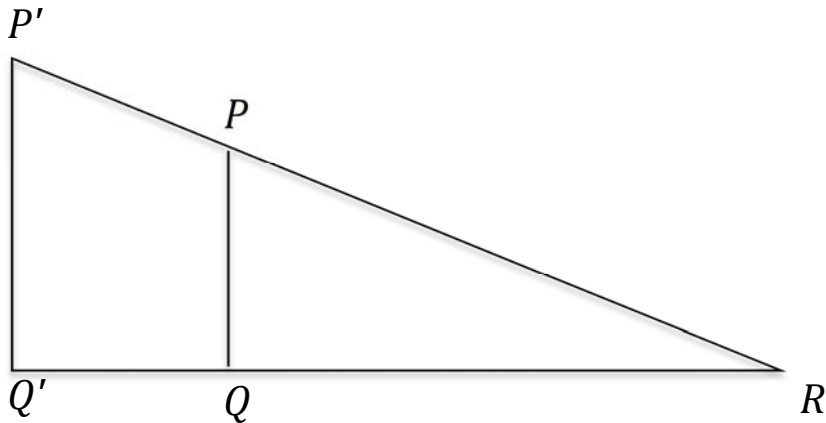
[2]

Question 8 This question is about graphs.

- a) Plot the graph of $y = x + 1$ for $-3 \leq x \leq 3$ [1]
- b) On the same grid plot the graph of $y = x^2 - 1$ for $-3 \leq x \leq 3$ [2]
- c) State the co-ordinates of the points of intersection of the two graphs. [2]
- d) Hence, or otherwise solve the following equation.
$$x + 1 = x^2 - 1$$
 [2]
- e) Find the equation of the line that passes through (0,4) and (2,0). State its gradient and intercept. [3]

Question 9 This question is about trigonometry.

In the triangle PQR angle $Q = 90^\circ$ $PQ=6\text{cm}$ $PR=10\text{cm}$



a) Find length QR

[2]

b) Find as fractions

i. $\sin P$

ii. $\cos P$

iii. $\tan P$

[3]

c) an isosceles triangle PQR has angle $P = 52^\circ$ find angles Q and R when

i. $P = Q$

ii. $Q = R$

[3]

d) The triangle $P'Q'R$ is an enlargement of PQR .

i) $P'R$ is 15cm.

ii) How long is $P'Q'$?

[2]

Question 10 This question is about probability.

a) I throw 2 fair dice. Find the probability of getting

- i. exactly two ones
- ii. a double (two of the same number)
- iii. two different numbers

[3]

b) I throw a fair coin 3 times

- i. Draw a tree diagram to show the possible outcomes of this process
- ii. Find the probability of getting at least 1 tail

[3]

c) A bag contains 6 balls of which 2 are black, 2 are red, one is blue and one is green. I pick out 2 balls at random without replacement. Find the probability that I pick:

- i. two black balls
- ii. two red balls
- iii. two balls of the same colour
- iv. two balls of different colours

[4]

END OF EXAMINATION